

CONCERNING THE PROBLEM OF INFECTIOUS DISEASE ERADICATION

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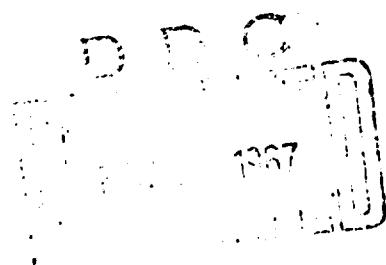
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U. S. ARMY  
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## CONCERNING THE PROBLEM OF INFECTIOUS DISEASE ERADICATION

[Following is the translation of an article by L. V. Gromashevskiy (Kiev), published in the Russian-language periodical Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii (Journal of Microbiology, Epidemiology and Immunobiology), No 12, 1965, pp 3--10. Translation performed by Dr. Charles T. Ostertag, Jr.]

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The problem of the eradication of infectious diseases is a new occurrence in the life of humanity. The main prerequisites of its formation are: a) the powerful development of the appropriate divisions of medical science and public health practice, and b) the formation of the system of socialist governments, leading public life in the beginning of a planned organization.

It cannot be said that effective measures for combatting infectious diseases, capable of leading to the eradication of some of them, were completely lacking in the historical past. For example, the isolation of persons with leprosy in "hospitals" (subsequently leprosariums) was begun in Europe in the XI--XII centuries, and by the XIX century many of the European countries were completely free from this disease; vaccination against smallpox was discovered in the end of the XVIII century by Jenner, and in several of the more economically developed capitalist countries by the end of the XIX century endemic morbidity was apparently brought down to zero (that is it was practically eradicated); in Denmark, since 1893 following the introduction of compulsory hospitalization of typhus patients, typhus disappeared. Similar process are also known in respect to other infections.

In subjecting the experience of the past to an analysis it is possible to make a number of theoretical generalizations. First of all, in all the known cases when the struggle with a specific infectious disease ended in its elimination within the confines of a country or a number of countries, it was achieved in the presence of an effectively operating technical method, the mechanism of action and application of which were completely understandable to the executors, and the realization of which was especially technical, organizational and economical. Secondly, it can be seen that such an expedient was strictly specific primarily against a definite disease. Thirdly, the period required for the eradication of a disease, depending on the conditions and nature of the method used for combating it, was very diverse -- from several years up to many centuries. Finally, with the successful carrying out of the measures their results were not evaluated theoretically, but usually were interpreted as an accomplished act.

Of course, it cannot be said that individual leading public health workers and scientists did not welcome the fact of the lowering or even the complete cessation of incidence with this or that disease, but accepted these successes purely empirically. In many countries, where the complete cessation of cases of smallpox, typhus, relapsing fever, etc. came about, this result was expressed in a way that in the annual combined statistical reports

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on infectious diseases the corresponding column was left empty. In the literature of the XIXth and the first quarter of the XXth centuries we were not able to find one scientific paper which contained a theoretical appraisal of the condition achieved or which critically analyzed the causes and forces leading to the stated result.

Leprosy was one of the infections which excited the most interest. But the main controversies surrounding it were mainly in regard to its infectiousness, that is they reflected essentially the differences in the opinion of miasmatisists and contagionists, but touched little on the main problem concerning the eradication of infectious disease. It is characteristic that dozens of authors, interested in the history of cholera epidemics of the XIXth century ("Pandemics" according to Girsh), touched upon many works describing the origination and distribution of each epidemic, but hardly any of them thought seriously about what were the reasons that each of these epidemics invariably ended in the countries with a moderate climate. If all the same such a fact could sometimes be stated, then it was specified as the "Disappearance" of the disease or the "cessation" of incidence. No wonder Sh. Nikol, himself being an active fighter with infectious diseases, wrote a book under the title of "The Birth, Life and Death of Infectious Diseases."\* The philosophical thought of the book was that individual diseases went through a life cycle similar to an individual organism, ending their existence with a natural "death." Of course, similar scientific concepts did little for the theoretical development of the conception of the "eradication of infectious diseases."

Perhaps the most well known measures, directed at the eradication of infectious diseases within the capitalistic system, were carried out during the period of the great campaign in the beginning of the 20's. This had the goal of destroying yellow fever and necatoriasis in the countries of Central and South America. The campaign was carried out by the Panamerican Sanitary Bureau with the support of the North American Rockefeller Institute (New York). In spite of the considerable effect obtained as a result of this work, they were not able to achieve complete success in destroying these infections. And in the sense of the idea and the theoretical armament this great experiment gave still less. It not only did not serve as a basis for development of a theory on the eradication of infectious diseases, but even the partial failures in the struggle with yellow fever in a number of economically undeveloped regions of South America were taken as an argument in favor of the impossibility of completely solving the problem.

However, the data cited doubtlessly shows that modern science has the means at its disposal which may be used in specific cases for achieving the goal which interests us. Below we will present several more facts

\*USSR, this paper by Sh. Nikol was published by the Medgiz Publishing House under a changed name ("Past, present and future of infectious diseases"), which to a certain degree shades the idea contained in the material presented.

strengthening this conclusion, but first we will dwell briefly on those prerequisites which served as the basis for the ideological realization of the mission of eradicating infectious diseases.

It is known that the very fact of the emergence of the first socialist country served as the basis for the forced changes and imitation of the Soviet Union in the countries under the capitalistic system. As an example it is sufficient to point out such facts as the spreading of the 8-hour working day and worker's insurance in the capitalist countries after the Great October Socialist Revolution in Russia or the attempts to plan the development of the economy in several countries. As regards the Soviet Union, and following the Second World War the collaboration of the Socialist countries also, then these events were conducted in turn on the theoretical and practical problem of eradicating infectious diseases. The bases for these were the planned beginning, encompassing all aspects of economic and public life in the socialist society, the transfer of public health affairs into the field of government activity and the great expansion of medical work in which the antiepidemic struggle occupied a significant place, acceptance as government doctrine the advanced Marxist-Leninist science, and finally the critical review and assimilation of world experience in struggling with infectious diseases and regeneration on the level of the modern achievements of advanced epidemiological science.

Following the creation of the World Health Organization (WHO) in 1946 and the subsequent successes in the development of world science, the concept of the liquidation of individual infections, based on the terminology of WHO - extermination ("eradication"), became still more contemporary and necessary.

Turning to the actual achievements in the area of eradicating infectious diseases in the Soviet Union, the following facts can be noted.

In the 20's in old Bukhara attention was turned to a persistent focus of a parasitic disease - guinea worm (*Dracunculus* - worm disease). The essence of the disease is that man swallows the invasion stage (larva) of the parasitic worm (historically this is doubtlessly a zoonotic disease) when drinking infected water. The parasite, which has reached the digestive tract of man, does not remain to parasitize in the intestines similar to other helminths, but in searching for a reliable mechanism of transmission\*\* penetrates through the mucous membrane into the blood system and, being carried with the flow of blood to the surface capillaries of the lower extremities, emerges from the blood system here and situates itself in the subcutaneous cellular tissue right under the skin. When the process of sexual maturation of the parasite has concluded and the formation of mature eggs begins, the parasite guarantees itself an exit opening in the distal sector of the lower extremity, through which the eggs of the parasite are discharged outside with the pus and wound secretion. The disease may exist in a specific form of water supply, when the water which is used for the daily needs of the

\*\*Of course here we have in mind the biological process of adaptation and natural selection.

population is contained in small standing water reservoirs ("Khausy"). When scooping water from them man has to place his feet in the water. This is when the eggs of the parasite are washed off. In the water the larvae emerge from the eggs and transform into an "invasion" form, capable of infecting man or animal.

The great Soviet parasitologist Professor L. M. Isayev of the Samarkand Medical Institute studied this problem in detail under local conditions, developed a system for supplying the city with water and strived for the realization of the measures proposed by him. This work was carried out by him over a period of approximately 5 years (1928--1932) and led to the complete extermination of guinea worm in Bukhara. And since this disease, which is very widely distributed in a number of subtropical and tropical countries of Asia and Africa, was represented in the USSR in only one focus in Bukhara, then in actuality this disease was eradicated in the Soviet Union.

In spite of the limited scale of this experience, it was correctly appraised as an actual case of the biological extermination of the disease and its causative agent in a specific territory.

In the beginning of the 30's, in spite of the fact that in the Soviet Union a state law for the compulsory small pox vaccination was in effect, as a result of a weakness in the medical-sanitary service and the great deal of movement by the population (in connection with the increasing industrial construction) a considerable unsafe situation for small pox was observed. In searching for ways of intensifying the struggle with serious danger, the People's Commissariat for Public Health of the RSFSR made the decision in 1935 to carry out a compulsory inoculation of the entire population against small pox; the People's Commissariats of other Union Republics followed this example. In 1936 the same method was repeated.

There is no doubt that small pox has been completely eradicated in the USSR, since the virus--causative agent of this disease no longer exists in the country. However this does not guarantee the country against possible importation of the infection from other countries, since small pox still has not been eradicated on a world scale. And the droplet mechanism of transmission of the infection places everyone coming in contact with such a source under the threat of contamination if they do not possess a sufficient full-value immunity. Unfortunately the eradication of small pox in the USSR in 1936 - this is a fact of great principle significance -- did not serve as material for a comprehensive study and description of it which it merited.

In this connection it is necessary to mention the event which took place in 1939 when the All-Union Conference of the Scientific Society of Microbiologists, Epidemiologists and Infectious Disease Specialists, based on a report by the author of this article, recognized the practicable eradication of typhus and accepted the recommended program for carrying out this mission. This was confirmed in the history of the following years in the struggle with this infection. And if sometimes obstacles arose on this path, then they did not result from deficiencies in the program adopted but were the result of deviations from it.

Primarily in the USSR, especially beginning with the 30's, statements appeared for the first time which really considered the problem of the eradication of individual infectious diseases and in principle appraised the available possibilities, perspectives and paths for resolving this mission. It is necessary to note the statement by Academy Member K. I. Skryabin, who proposed "devastation" as a principle for struggling with helminthiases, that is, the destruction of the parasite by the available means in all stages of its development and in all forms of its existence. Then began the successful realization of the plan for the eradication of malaria. The plan was scientifically sound, well developed, and strengthened with the technical and material means and special cadres. At present it is close to complete accomplishment. The honor of developing and supervising the realization of this plan belongs to the original Soviet school of parasitologists headed by Active Member of the USSR Academy of Medical Sciences Professor P. G. Sergiyev. We could point out a number of similar cases, however, we will restrict ourselves and move to the famous decree of the Central Committee of the CPSU and the Council of Ministers, USSR, 14 January 1960, devoted to the improvement of medical service for the population, since a significant place in it is occupied by decisions related to the lowering and eradication of infectious diseases in the USSR. It must be stressed that the publication of a government decree, providing for similar missions in the area of public health, was an unprecedented fact in the history of humanity, accomplished in a socialist country.

However, it would be a great mistake to maintain that the problem of the eradication of infectious diseases can be considered sufficiently mastered both in a theoretical and in a practical respect.

We will begin from the fact that the problem concerning the eradication of infectious diseases still remains insufficiently popular and not given by wide circles of specialists. As a result of a minor discussion of it, carried out in recent years on the pages of the Journal of Microbiology, Epidemiology and Immunobiology, it was possible to expose a general line in this problem which favored the majority of authors taking part in this discussion. However, the problem remained far from exhausted. First of all it is necessary to note the limited number of specialists who presented their point of view on this problem; secondly, this was the reason that this vast and many-sided problem was not developed in the direction of breaking it down and shedding light on the multitude of particular problems and questions which themselves would promote a completely new approach to the struggle with infectious diseases; and thirdly, and this is most important, wide circles of medical workers in all the specialties are not sufficiently acquainted with the problem, and besides this there could hardly be such a medical specialty or area of work which would remain indifferent to a discussion of the problem of the eradication of infectious diseases.

Along with this it is necessary to note that if it is possible to complain about the inadequacy of the scientific and literary interpretation of this problem, then one cannot speak of the inadequacy in mentioning the corresponding combination of words ("eradication of infectious diseases") in everyday life. In the general and nonspecialized medical press, in the

sanitary-instruction oral and printed speeches, in lectures and other forms of educational work, in the administrative directives and correspondence of medical organs, in the speeches of scientific authorities, in business and conversational speech, etc., this terminology is widely used, but up until now a generally accepted, and compulsory for manuals, definition of the concept of "liquidation" does not exist. And as it usually is in such cases, in serious problems everyone understands the assumption which pleases him.

It was stated above that a general line was revealed in this problem. An infectious disease is a specific biological phenomenon. For each concrete disease there is a specific causative agent which is the factor determining the existence of the disease in nature. All the modern sciences on infections and infectious diseases are based on this proposal. And these are primarily the etiological sciences -- microbiology, virology, and parasitology. Each causative agent of an infectious disease, regardless of its position in the system of living organisms, is a parasite on its biological host and can serve as the cause of its illness. Outside of the organism of its biological host the parasite dies sooner or later if it is not included in the process realized by that mechanism of transmission from an infected organism to another analogous (susceptible) organism which is used by the certain causative agent. The continuous harmony between the causative agent (the cause, "etiology") and the disease (the result) is regulated by this indestructible bond. And since the origination of a specific infectious process (disease) is impossible without the presence of a specific causative agent, then there is no possibility of the natural existence in nature of a causative agent outside of the specific infectious process which is appropriate for that causative agent. Above we saw the precise reproduction of this regularity in the examples of the eradication of smallpox and guinea worm. In the same way it is not difficult to be convinced during an analysis of any analogous example.

Thus, the only practically achievable form of eradication of a specific infectious disease is the simultaneous destruction of the corresponding causative agent.

In the above mentioned literary discussion the majority of participants supported this proposal. Biologically such a definition must be considered fully maintained. In biology many extinct, complete vanished, species are known. But species which are being preserved in a limited number cannot be considered as "died out." On the other hand, in respect to such species often special measures are taken for the purpose of preventing their complete extinction. This emphasizes their complete viability. In general science knows of no cases of the spontaneous (autocathonous) extinction or dying off of species under the influence of internal causes\*\*\* -- "aging" or "degeneration" (for an example, the above mentioned inaccurate concept by Sh. Nikol, the widely spread common antiscientific concepts, etc.). Species may die off under the influence of unfavorable changes in the conditions of the surrounding medium in the event that these changes based on their abruptness and rapidity exceed the capability of the representatives of this species for

\*\*\*Therefore, the intensified spreading by certain scientist-medics of reactionary antiscientific "theories" concerning the spontaneous saprophitization of causative agents bears nothing but harm.

adaptation. Man, in changing the nature ("purging factor") of his activity, in particular by destructive or, conversely, stimulating actions, considerably influences the status of the flora and fauna of the Earth. Of course the activity of man, directed at the eradication of infectious disease and accompanied, as it was shown, by the destruction of the species of the corresponding causative agent, bears a specific nature.

The eradication of an infectious disease is the final step in the successful struggle with that disease. We will recall that the struggle with each infectious disease is a completely specific system of measures, including all the effective measures aimed at rendering the source of the infection harmless (slaughtering infected animals, isolation and specific treatment of patients, separation and removal of healthy carriers of contamination from the carrying state, etc.), interrupting the mechanism of transmission of the causative agent (sanitary-improvement measures, disinfection, etc.), and active and passive immunization. The entire group of measures directed against a certain infection should be well mastered, the effectiveness of each measure studied comprehensively and appraised objectively, and the practicability of use (technical and material means, cadres, organization and others) fully guaranteed. Historical experience shows that in the modern level of development the diseases available for eradication are those against which there is at least one highly effective means capable of completely stopping the epidemic process during the infection and eradicating the disease, and together with this, destroying its causative agent. This was shown above for a number of infectious diseases (leprosy, smallpox, guinea worm, glanders).

In our opinion what has been said can serve as the basis for carrying out a tremendous scientific-practical operation for isolating those diseases which on the level of the modern achievements of science and organizational possibilities can be designated as accessible for eradication. Such an operation should be carried out with sufficient competence and discretion and obtain the support and approval of the qualified scientific community. In all other cases, when the true eradication of an infectious disease under modern conditions is unrealistic, it is possible to set up any other attainable goal which can be accurately formulated, for example, "barring of lethal outcomes," "reduction of incidence" to a specific incidence or by a specific number of times, etc., but not in any of such cases can the mission be termed "liquidation."

However, it has to be acknowledged that it would have been easy and successful to operate if all the guidance in the struggle with infectious diseases on all levels of this work adhered step-by-step with the general line described in general features above. As in every great principal theoretical problem, during the resolving of the practical mission in the present age one must encounter various deviations from the general line and interpretations emanating in the capitalist countries from persons adhering to points of view which are evidently inaccurate or antagonistic in a scientific, theoretical or methodical respect. In the USSR analogous positions are occupied by persons obsessed with more or less distinct derivatives of those



same faults, and often the same can be simply heard from persons who are little competent in the problem being discussed. And in this case it can be said boldly based on an analogy with the phenomena of public-political life concerning the existence of "right" opportunistic and "left" adventurist deviations in this problem.

Followers of the right deviation are possessed with scepticism in the feasibility of eradication, though openly they often speak about this and usually accept the term "eradication", but for reinsurance they add to it a term equivalent to the idea of "noneradication" (for example, "eradication of the epidemic state," "eradication of mass incidence," "practical eradication," etc.), that is they want "eradication without eradication."

As regards the second deviation, then its supporters are prepared in words to "eradicate" all infectious diseases without selection. Some representatives of this trend accept it as a rule not to use the words "infectious disease" without accompanying it with the word "eradication." And since in the depth of the mind they understand that nothing comes out of this except chatter, then they, just as the representatives of the first deviation, are willingly resorting to the same stipulation speaking for "noneradication."

Thus, the "right" and "left" deviations combine, just as this happens in political life, forming in essence a single opportunistic stream. It is necessary to pay a decisive rebuff against this flow, since to not fight "on two fronts" means to further the disorganization of the general line. Of course, it would be more comprehensive to examine the stated deviations from social-political and special-scientific positions, however, the shortage of space does not permit us to do it. We will only note that in the present phase of this problem the "left" opportunism represents a great danger.

Considering the complexity of the position created, when the task of "eradicating" infection becomes the object of government regulation, and the conception itself remains undefined and interpreted by each from subjective positions, during the course of the XXth session of the Academy of Medical Sciences, USSR, in the general meeting of the Department of Hygiene, Microbiology and Epidemiology the problem was raised concerning the necessity of establishing a definition of the concept "eradication of infectious disease."

The general meeting of the department commissioned the author of this article to devise such a definition. This commission was fulfilled and we proposed the definition of the concept "eradication of infectious disease" be in the following form: "The term "eradication of infectious disease" denotes the complete destruction of a given infectious disease within the limits of a country (government), a number of countries, or the entire world, accompanied by the complete destruction or disappearance from the corresponding territory of the causative agent of that disease, which excludes any possibility of the emergence of the eradicated infection in any form among the inhabitants of the territory without the causative agent being brought in anew.

Annotation. The stated definition completely preserves its force in the event of the storage of the causative agent of the disease on the territory where this disease was eradicated in the form of a reference or other scientifically approved method of storage under conditions excluding a diversion or other unscrupulous action contradictory to antiepidemic principles."

The proposed arrangement was discussed on 5 May 1964 at a meeting of specialists and did not cause one objection. Therefore, it can be accepted as an official document defining the concept of "eradication of infectious disease."